

# Interfacing Servo Motor with AVR (Firebird V)

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# Agenda of Discussion

## 1 Introduction

## 2 Servo motor

- Principle and Working
- Operating Servo Motor
- Selection of Servo motor

## 3 AVR ATmega2560

- Generating PWM signals
- Code



# Prerequisite knowledge

- 1 Basic IO Interfacing using ports
- 2 Working with Timers and basic knowledge of registers of ATmega2560.



# Introduction

- Servo motors (or servos) are self-contained devices that rotate or push parts of a machine with great precision.
- Servos can put out about 42 oz/in of torque.
- Relatively inexpensive.
- Widely used for educational purpose in mechatronics as they can be controlled by a microcontroller.



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  - potentiometer





# Principle and Working

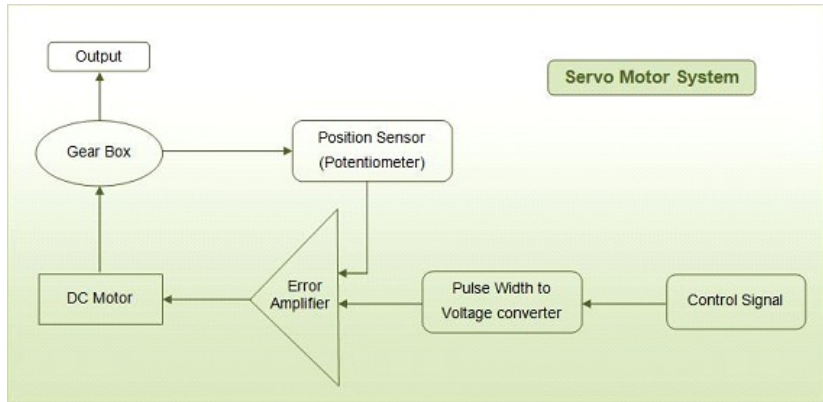
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  - control circuitry.



# Principle and Working

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  - dc motor
  - gear train
  - potentiometer
  - control circuitry.
- Forming closed loop control system.





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- Reaching desired angle, there would not be any difference in the signals fed to error detector.



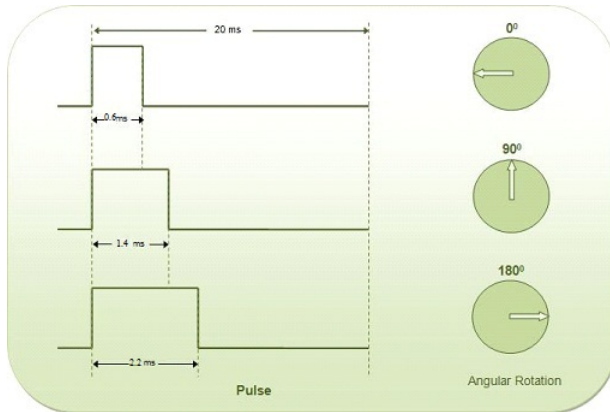
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- Resultant signal from error detector acts as input to the dc motor to rotate.
- Also rotating the potentiometer knob coupled with its shaft via gears.
- Reaching desired angle, there would not be any difference in the signals fed to error detector.
- Resulting in motor to stop rotating and wait at that position





# Operating servo motor

- 'on-time' of a PWM signal is used as control signal to rotate motor at particular angle.



- This time period depends on the servo used and not on total time period or duty cycle of PWM signal.



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- Graph of on-time period vs. angle is linear.
- Range of PWM frequency for operating servo is 40-60 Hz



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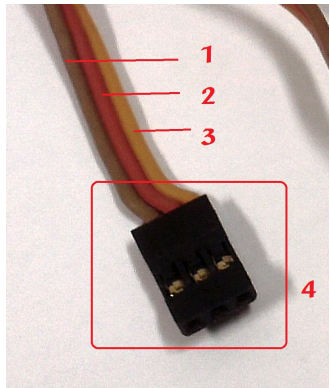
# Selection of Servo motor

Servo is selected based on its:

- Torque
- Speed
- Weight
- Dimensions



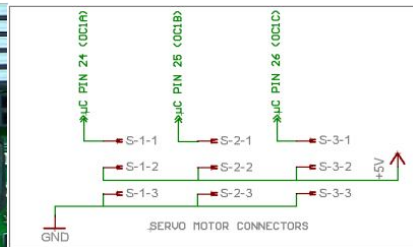
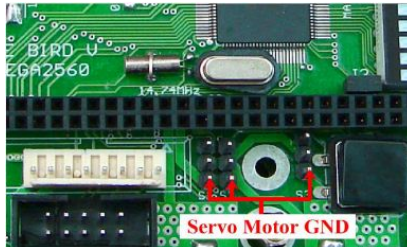
# Servo connector



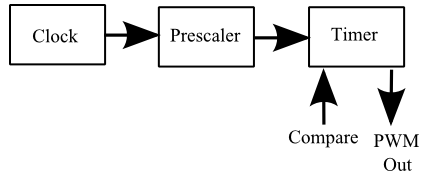
- 1– Ground
- 2– Power
- 3– Control signal
- 4– Connector to controller



# Interfacing servo with Firebird V



# Using Timer1 for PWM generation



- Timer1 in Fast PWM mode is used here.
- Fast PWM in mode 14 is used to rotate servo motor.

11	1	0	1	1	PWM, Phase Correct	OCRnA	TOP	BOTTOM
12	1	1	0	0	CTC	ICRn	Immediate	MAX
13	1	1	0	1	(Reserved)	–	–	–
14	1	1	1	0	Fast PWM	ICRn	BOTTOM	TOP
15	1	1	1	1	Fast PWM	OCRnA	BOTTOM	TOP

WGM bit description



# Generating PWM signals contd.

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- $f_{cpu} = 14745600Hz$



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- Value of channel A of OCR register will be:  
 $OCR1A = T_{on} \left( \frac{f_{cpu}}{N} \right) = T_{on} * 57600$
- Values of registers like TCCR1A/B and TCNT1 can be found using ATmega2560 datasheet.



# Code

Simple code

## Header files





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### Port Initialization

```
void port_init()
{
  DDRB = DDRB | 0x20;
  PORTB = PORTB | 0x20;
}
```



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As the relation between on-time period and corresponding degree is linear, so is the relation between the count value in OCR and degree.



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```
float regval = ((float)degrees * 0.512) + 34.56;  
OCR1A = (uint16_t) regval;
```



# Thank You!

Post your queries on: [helpdesk@e-yantra.org](mailto:helpdesk@e-yantra.org)

